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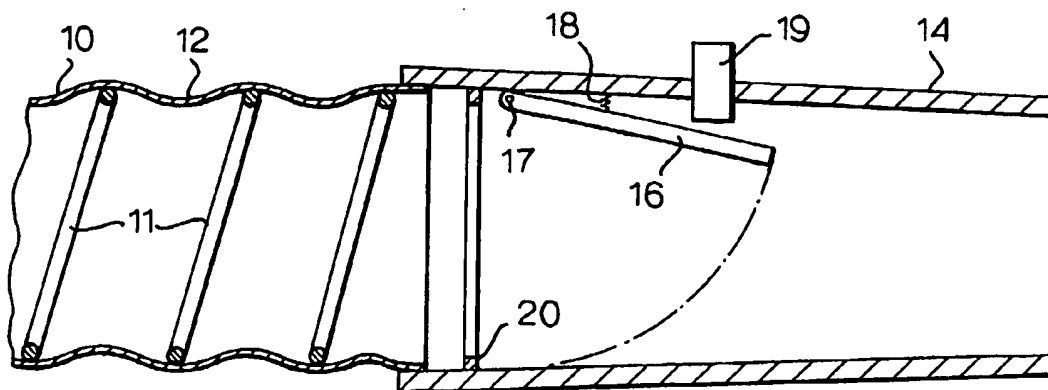
- as to the identity of the inventor (Rule 4.17(i)) for all designations
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(54) Title: **VACUUM CLEANER APPARATUS AND HOSE THEREOF**



(57) Abstract: A vacuum cleaner has a hose (10, 30, 30') that is retractable in length by the application of reduced pressure from the vacuum cleaner. After use, the free end (14, 21, 33) of the hose is occluded so that pressure falls within the hose and it is retracted in length. The hose is restrained in its shortened length before suction is turned off. The hose in its retracted state may be stored on or off the vacuum cleaner.



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VACUUM CLEANER APPARATUS AND HOSE THEREOF

Technical Field

This invention relates to vacuum cleaner apparatus of the kind including a suction inlet and a hose connected with the inlet..

Background Art

Vacuum cleaners may be of the upright kind where cleaning suction is applied by means of a pump having an inlet directly below the machine. Cylinder vacuum cleaners, by contrast, have an inlet to which one end of a hose is connected, the other end being connected to a suction head. Upright cleaners also usually have provision by which a hose can be connected to the inlet so that a hand-held suction head can be used to clean regions that would otherwise be inaccessible to the machine. The hoses used with vacuum cleaners tend to be bulky so that they have to be stored separately from the cleaner. An alternative hose available on some vacuum cleaners as sold by the major manufacturers has stretch characteristics with a natural, retracted length (when not in use) that is less than its extended length (when in use). The extended length may be about five times the retracted length. Although this hose has the advantage of being much easier to store than conventional hoses, its resilience may make it more difficult to use in some situations, especially with cylinder vacuum cleaners, which are lighter than upright cleaners.

Disclosure of the Invention

It is an object of the present invention to provide an alternative hose and vacuum cleaner apparatus including such a hose.

According to one aspect of the present invention there is provided vacuum cleaner apparatus of the above-specified kind, characterised in that the hose has a first length during normal use and a second length shorter than the first length when the end of the hose remote from the inlet is occluded so that pressure falls within the hose.

A part at least of the length of the hose may have a natural extended length. A part at least of the hose may have a natural retracted length. The hose may include a valve towards

the end remote from the inlet for occluding the hose. The apparatus preferably includes a restrainer for restraining the hose in its shorter length. The restrainer may be fixed with a housing of the apparatus and may include a sleeve within which the hose is retracted. The apparatus may be portable.

According to another aspect of the present invention there is provided a hose for a vacuum cleaner according to any one of the preceding claims.

The hose may have a natural extended length and be retractable in length by the application of reduced pressure within the hose. The hose preferably has an occluder towards the end of the hose remote from the vacuum cleaner apparatus for occluding passage of air through the hose so that suction applied by the vacuum cleaner apparatus creates a reduced pressure within the hose sufficient to shorten the hose to its retracted length. The hose may include a retainer arranged to retain the hose in its retracted length such that the hose and retainer can be removed from the vacuum cleaner and stored separately in a retracted state. The hose preferably includes an inner resilient helical support member having a natural extended length and an outer sleeve of a flexible material attached with the support member.

According to a further aspect of the present invention there is provided a method of operating vacuum cleaner apparatus including the steps of applying suction to one end of a flexible hose, using a cleaning head at the opposite end of the hose to clean, occluding flow of air through the hose at the opposite end, allowing pressure in the hose to reduce sufficiently to retract the hose in length, restraining the hose in its retracted length and turning off suction power.

The method may include the step of removing the hose from the vacuum cleaner apparatus in its retracted state.

Vacuum cleaner apparatus including a hose according to the present invention, will now be described, by way of example, with reference to the accompanying drawings.

Brief Description of the Drawings

- Figure 1 is a side elevation view of a vacuum cleaner and hose;
- Figure 2 is a plan view of the cleaner and hose of Figure 1;
- Figure 3 is a perspective view of the cleaner without the hose;
- Figure 4 is an enlarged, simplified sectional elevation view of a part of the hose;
- Figure 5 is a side elevation view of a part of an alternative hose having alternative means for blocking the hose;
- Figures 6 to 8 are side elevation views of three alternative forms of retainer for the hose;
- Figure 9 is a perspective view of another alternative retainer; and
- Figure 10 is an enlarged simplified elevation view of a part of an alternative hose;

Best Modes for Carrying Out the Invention

With reference first to Figures 1 to 4, the vacuum cleaner is of the portable cylinder type having a housing 1 with wheels 2 on its lower surface and a suction inlet 3 at one end. The cleaner includes a conventional pump and dust collection bag or other container (not shown). On one side of the housing 1 there is a hose restraint and mount in the form of a bracket 4 with a U-shape flange 5, the purpose of which will become apparent later.

The cleaner also includes a hose 10. The hose 10 is of a flexible, corrugated construction including a resilient, helical reinforcement member in the form of a spring metal wire 11 internally supporting an outer highly flexible plastics sleeve 12. The reinforcement helix could be of a resilient plastics material. The reinforcement wire 11 is formed so that it

has a naturally extended state but can be compressed axially against its resilience by an applied external force. The sleeve 12 is sufficiently flexible that the hose itself naturally takes up the extended length of the reinforcement wire helix 11, as shown in broken outline in Figures 1 and 2. As shown in Figure 4, the sleeve 12 of the hose, in its extended state, has inwardly-extending shallow valleys between each turn of the reinforcement. This allows the sleeve to fold up internally between the turns of the turns of the reinforcement so that the hose can retract freely when a compressive force is applied. Alternatively, as shown in Figure 10, the sleeve 12' may have shallow hills extending outwardly between turns of the reinforcement element 11'. This allows the sleeve 12' to fold outwardly when the hose is retracted. This arrangement may have advantages in that the bore of the hose is not reduced during retraction so that the suction pressure along the length of the hose is maintained.

The stiffness of the hose construction can be tailored to give the desired rate of retraction.

At one end, the hose 10 has a conventional coupling 13 by which the hose is connected to the suction inlet 3 of the cleaner, this may include a swivel connection. At its opposite end, the hose 10 has a second coupling 14 by which the hose is attached to a cleaner head 15.

The coupling 14 includes within it means by which air flow through the hose 10 can be occluded. As shown in Figure 4, this takes the form of a flap 16 pivotally mounted at one end 17 within the coupling 14 and urged to an open, longitudinally-extending position by a spring 18. One end of a button 19 is exposed externally of the coupling 14, its other end being positioned above the flap within the coupling. By pushing down on the button 19, the free end of the flap 16 is also pushed down against the resilience of the spring 18. Once depressed a certain distance, air flow along the hose 10 causes the flap 16 to be pulled down to a vertical position where it abuts an annular seat 20 within the coupling and occludes the passage along the hose. The flap 16 remains in this closed position until suction is removed, when the spring 18 swings it back to its original position. The rear end of the coupling 14 locates on one side of the mounting flange 5 to retain the free end of the hose 10 in position

against the side of the cleaner housing 1, when not in use. The cleaner head 15 may be stored in a compartment within the housing 1.

To use the cleaner, the coupling 14 at the free end of the hose 10 is pulled out of the restraining bracket 4. This allows the hose 10 to adopt its natural extended state, which may typically be about 2m in length. The cleaner head 15 is then fitted on the coupling 14 and power to the cleaner is turned on so that it applies suction to the hose 10 and cleaner head. This is used in the conventional way, to suck dust and the like into the cleaner for subsequent disposal.

When the user has finished with the cleaner, before turning off power supply, he presses the button 19 at the free end of the hose 10, so as to close the valve 16 and prevent air flow into the hose. The pressure in the hose 10 between the valve 16 and the cleaner now drops rapidly. This applies an axial, compressive force to the hose 10, which is sufficient to retract it against the resilience of the reinforcement wire 11. The construction of the hose 10 is such that it retracts to a length substantially less than its natural length, typically about half its natural length, that is, about 1m long. The construction of the hose is selected such that the reduced pressure within the hose during normal cleaning operations is not sufficient to cause any appreciable retraction of the hose length. The user removes the cleaner head 15 and fits the coupling 14 into the restraint 4. Once the coupling 14 is fitted in the restraint 4, the power to the cleaner can be turned off. As soon as power is turned off, pressure will start to rise in the hose 10 because the vacuum cleaner is not air-tight, allowing air to enter and re-pressurize the hose. The retractive, compressive force on the hose will, therefore, fall and the hose will tend to resume its natural, extended length. However, because the free end of the hose 10 is restrained by the restraint 4, the hose will not be able to extend until released from the restraint. The hose restraint may include a shaped housing within which a major part of the length of the retracted hose is located. The hose 10 could be retained within a curved channel in the housing beneath a hinged lid of the housing so that it is completely enclosed.

The present invention enables a vacuum cleaner hose to be stored compactly without the need for the user to apply a force to extend the hose. This, therefore, enables the hose to

be used with lightweight cleaners, which might be pulled over or pulled along by pulling on a conventional stretch hose.

The hose need not have a natural extended length. The invention could also be useful where the hose has a natural retracted length. The resilience of the hose tending to retract it can be made weaker than in a conventional stretch hose because the reduced pressure created when the free end of the hose is occluded would help retract it. In this way, the problems associated with conventional stretch hoses on portable vacuum cleaners can be reduced or avoided because less force has to be applied to extend it. The hose could have a combination of the naturally-retracted and naturally-extended kinds and or alternatively, could have a section that is neither retractable or extensible.

It will be appreciated that the present invention is not confined to cylinder cleaners but could be used with, for example, upright cleaners.

The hose described above is constructed so that an increase in suction pressure causes a corresponding directly related reduction in hose length between the fully extended and fully retracted states. Alternatively, the hose could be constructed so that there is no significant reduction in length up to a certain suction pressure and, once a threshold is exceeded, the hose snaps to its fully retracted length. Such a hose can be provided by making the configuration of the corrugations asymmetrical.

The valve for preventing air flow along the hose can have many different constructions. The valve could be provided by some form of plug, such as shown in Figure 5 where a ball 20 is attached with the coupling 21 by a flexible elastic tether 22, so that the user simply holds the ball up to the end of the coupling to block flow. The valve need not totally block air flow but may be constructed to allow a reduced flow of air. This may be useful so as to reduce the speed at which the hose retracts. The valve could be adjustable to allow different rates of air flow. Instead of using a valve, the hose could be blocked simply by the user pressing his hand over the end of the coupling. The valve could be arranged so that it is automatically closed when the cleaner head is removed. The valve could have an electric operation so that it can be operated remotely, such as by a switch on the cleaner housing. This

might be arranged such that the OFF button on the cleaner automatically closes the valve before suction is turned off.

The hose need not be retained in its retracted state by the housing of the vacuum cleaner. Instead, some form of retaining means separate from the vacuum cleaner body could be provided, such as, for example shown in Figures 6 to 9.

Figure 6 shows a retractable hose 30 of the kind described above having a coupling 31 at one end connected with a vacuum cleaner housing 32 and a coupling 33 at its opposite end for connection to a cleaning tool (not shown). Attached with both couplings 31 and 33 is a cylindrical sleeve 34 and 35. One end of each sleeve 34 and 35 is attached with respective couplings 31 and 33, the other, free ends 36 and 37 of the sleeves extending towards one another. The free end 36 and 37 of each sleeve 34 and 35 is provided with some form of engaging means 38 and 39 adapted to engage one another and retain the sleeves together. The engaging means 38 and 39 may be of many different kinds, such as, for example, having an engaging lip and channel, catches that engage a surface formation, cooperating tapered fittings, engaging screw or bayonet fittings, magnetic members, engaging hook-and-loop fabric or the like. The sleeves 34 and 35 are preferably bendable so that they do not impede flexing of the hose. Because the sleeves 34 and 35 reduce flexing of the hose 30 at the couplings 31 and 33, they have the benefit of reducing cracking of the hose at the locations where damage is most usually caused. The length of the sleeves 34 and 35 is selected such that their combined length is equal to that of the retracted hose. When the end of the hose 30 is blocked so that it retracts, the two free ends 36 and 37 of the sleeves 34 and 35 come together so that the user can engage them with one another. The vacuum cleaner can then be turned off since the engaged sleeves 34 and 35 will retain the hose 30 in its retracted length. The retracted hose 30 can be stored on the vacuum cleaner body or it can be uncoupled at the coupling 31 and stored separately, such as by means of a hanging loop 40.

Instead of smooth sleeves, as shown in Figure 6, the sleeves 34' and 35' could be corrugated as shown in Figure 7, with a natural retracted length so that they cover less of the hose 30' when the cleaner is in use. To fasten the sleeves 34' and 35' together, the user simply

pulls their free ends 36' and 37' together to stretch out the sleeves to their full length so that the engaging means 38' and 39' can be fastened together.

It is not essential to have two sleeves at opposite ends since a single longer sleeve 42 could serve the same function, as shown in Figure 8.

The sleeve or sleeves need not be solid but could, for example, instead be provided by webbing material or by a series of straps disposed around the hose.

There are many alternative forms of retainer means that could be used to hold the hose in its retracted length. The retainer means could be in the form of a bag that is closed about the retracted hose. Such a bag could also have provision for storing the cleaning wands and accessories after detachment from the hose.

The retainer need not be permanently attached to the hose itself but could be a separate component that is only attached with the hose when the hose is retracted.

Figure 9 shows a separate retainer in the form of a rigid casing having two shells 50 and 51 joined together along their sides by a flexible hinge 52 and having semicylindrical recesses 53 on one surface. Semicircular ribs 54 and 55 at opposite ends of each shell are shaped to engage either the couplings at opposite ends of the hose or opposite ends of the flexible hose itself. The two shells 50 and 51 are folded together about the retracted hose and are fastened together by means of engaging catches 56. The casing preferably has flanges 57 at opposite ends shaped with recesses 58 into which the rigid cleaning wands or other accessories can be clipped, so that the hose and accessories can be stored together.

The retainer could extend internally within the hose and could, for example, be provided by a rigid vacuum cleaner wand and suitable couplings.

CLAIMS

1. Vacuum cleaner apparatus including a suction inlet (3) and a hose (10, 30, 30') connected with the inlet, characterised in that the hose (10, 30, 30') has a first length during normal use and a second length shorter than the first length when the end (14, 21, 33) of the hose remote from the inlet (3) is occluded so that pressure falls within the hose.
2. Vacuum cleaner apparatus according to Claim 1, characterised in that a part at least of the length of the hose (10, 30, 30') has a natural extended length.
3. Vacuum cleaner apparatus according to Claim 1, characterised in that a part at least of the length of the hose has a natural retracted length.
4. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the hose includes a valve (16) towards the end remote from the inlet (3) for occluding the hose.
5. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the apparatus includes a restrainer (4, 34, 35, 34', 35', 42, 49) for restraining the hose (10, 30, 30') in its shorter length.
6. Vacuum cleaner apparatus according to Claim 5, characterised in that the restrainer (4) is fixed with a housing of the apparatus.
7. Vacuum cleaner apparatus according to Claim 5 or 6, characterised in that the restrainer (34, 35, 34', 35', 42, 49) includes a sleeve within which the hose (30, 30') is retracted.
8. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the apparatus is portable.

14. A hose (10, 30, 30') for a vacuum cleaner according to any one of the preceding claims.
15. A hose for vacuum cleaner apparatus, characterised in that the hose (10, 30, 30') has a natural extended length and is retractable in length by the application of reduced pressure within the hose.
16. A hose according to Claim 15, characterised in that the hose (10, 30, 30') has an occluder (16) towards the end of the hose remote from the vacuum cleaner apparatus for occluding passage of air through the hose (10, 30, 30') so that suction applied by the vacuum cleaner apparatus creates a reduced pressure within the hose sufficient to shorten the hose to its retracted length.
17. A hose according to Claim 15 or 16, characterised in that the hose (30, 30') includes a retainer (34, 35, 34', 35', 42, 49) arranged to retain the hose in its retracted length such that the hose and retainer can be removed from the vacuum cleaner and stored separately in a retracted state.
18. A hose according to any one of Claims 15 to 17, characterised in that the hose (10, 30, 30') includes an inner resilient helical support member (11, 11') having a natural extended length and an outer sleeve (12, 12') of a flexible material attached with the support member.
19. A method of operating vacuum cleaner apparatus including the steps of applying suction to one end of a flexible hose (10, 30, 30'), using a cleaning head (15) at the opposite end of the hose to clean, occluding flow of air through the hose at the opposite end (14), allowing pressure in the hose to reduce sufficiently to retract the hose in length, restraining the hose in its retracted length and turning off suction power.

20. A method according to Claim 19, characterised in that the method includes the subsequent step of removing the hose (30, 30') from the vacuum cleaner apparatus in its retracted state.

AMENDED CLAIMS

[received by the International Bureau on 23 Dec 2002 (23.12.02);
original claims 1-20 replaced by amended claims 1-24 (4 pages)]

1. Vacuum cleaner apparatus including a housing (1) having a suction inlet (3) and a hose (10) connected with the inlet, the hose (10) having a first length during normal use and a second length shorter than the first length when the end (14, 21) of the hose remote from the inlet (3) is occluded so that pressure falls within the hose, characterised in that the housing (1) includes a formation (4) for restraining the hose in its shorter length.
2. Vacuum cleaner apparatus according to Claim 1, characterised in that a part at least of the length of the hose (10) has a natural extended length.
3. Vacuum cleaner apparatus according to Claim 1, characterised in that a part at least of the length of the hose has a natural retracted length.
4. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the hose includes a valve (16) towards the end remote from the inlet (3) for occluding the hose.
5. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the hose has a helical support member (11') and a sleeve (12') attached thereto, and that the sleeve (12') is arranged to fold outwardly between turns of the helical support member (11') when the hose is retracted in length.
6. Vacuum cleaner apparatus according to any one of the preceding claims, characterised in that the apparatus is portable.
7. A hose (10) for vacuum cleaner apparatus according to any one of the preceding claims.
8. A hose according to Claim 7, characterised in that the hose (10) has an occluder (16) towards the end of the hose remote from the vacuum cleaner apparatus for occluding

passage of air through the hose (10) so that suction applied by the vacuum cleaner apparatus creates a reduced pressure within the hose sufficient to shorten the hose to its retracted length.

9. A hose according to Claim 7 or 8, characterised in that the hose (10) includes an inner resilient helical support member (11, 11') having a natural extended length and an outer sleeve (12, 12') of a flexible material attached with the support member.
10. A hose according to Claim 9, characterised in that the outer sleeve (12') folds outwardly between the turns of the helical support member when the hose is retracted.
11. A method of operating vacuum cleaner apparatus including the steps of applying suction to one end of a flexible hose (10), using a cleaning head (15) at the opposite end of the hose to clean, occluding flow of air through the hose at the opposite end (14), allowing pressure in the hose to reduce sufficiently to retract the hose in length, maintaining the end of the hose (10) on a housing (1) of the apparatus to retain it in its retracted length, and turning off suction power.
12. Vacuum cleaner apparatus including a suction inlet (3) and a hose (10) connected with the inlet, the hose (10) having a first length during normal use and a second length shorter than the first length when the end (14, 21) of the hose remote from the inlet (3) is occluded so that pressure falls in the hose, characterised in that the hose (10) has a helical support member (11') and a sleeve (12') attached thereto, and that the sleeve (12') is arranged to fold outwardly between turns of the support member (11') when the hose is retracted in length.
13. Vacuum cleaner apparatus according to Claim 12, characterised in that a part at least of the length of the hose (10) has a natural extended length.
14. Vacuum cleaner apparatus according to Claim 12, characterised in that a part at least of the length of the hose has a natural retracted length.

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Fig.3.

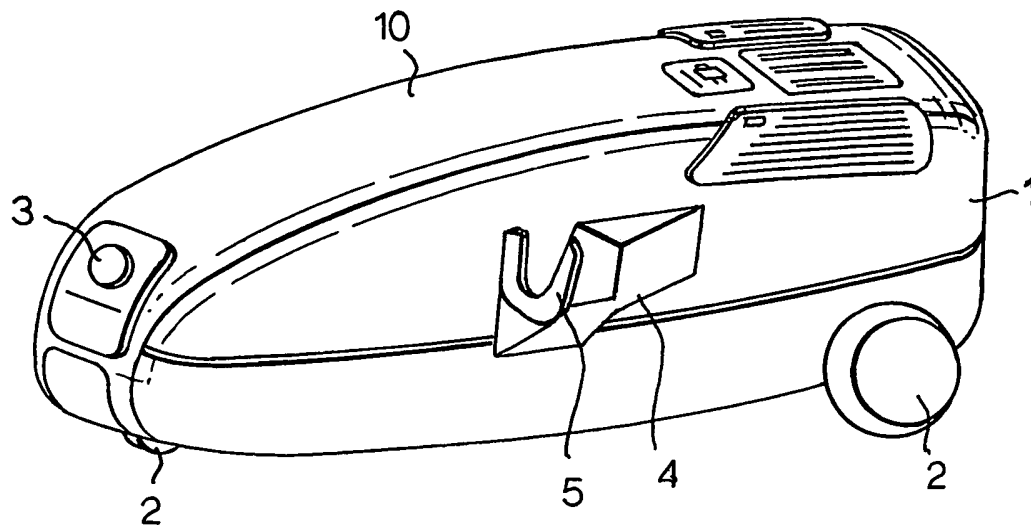
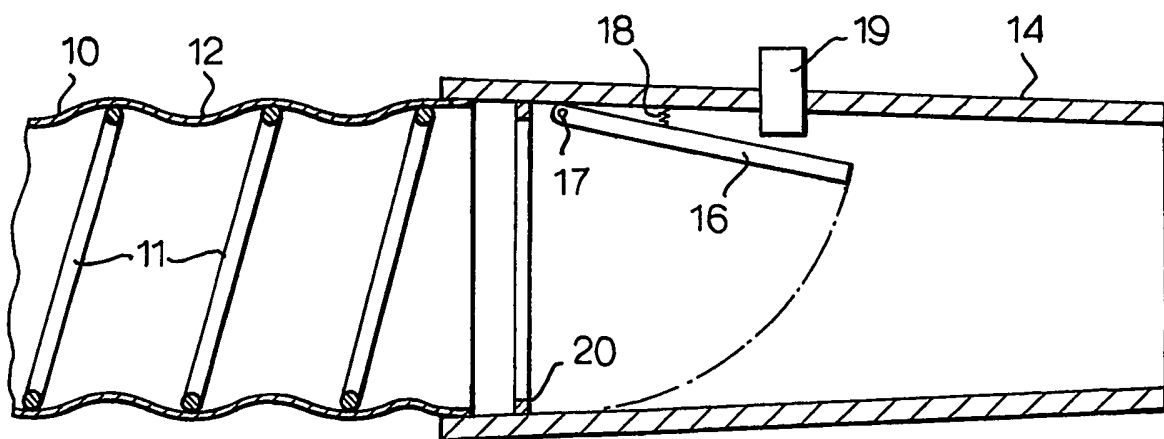


Fig.4.



15. Vacuum cleaner apparatus according to any one Claims 12 to 14, characterised in that the hose includes a valve (16) towards the end remote from the inlet (3) for occluding the hose.
16. Vacuum cleaner apparatus according to any one of Claims 12 to 15, characterised in that the apparatus includes a restrainer (4, 34, 35, 34', 35', 42, 49) for restraining the hose in its shorter length.
17. Vacuum cleaner apparatus according to Claim 16, characterised in that the restrainer (4) is fixed with a housing (1) of the apparatus.
18. Vacuum cleaner apparatus according to Claim 16 or 17, characterised in that the restrainer includes a sleeve within which the hose is retracted.
19. Vacuum cleaner apparatus according to any one of Claims 12 to 18, characterised in that the apparatus is portable.
20. A hose for vacuum cleaner apparatus according to any one of Claims 12 to 19.
21. A hose according to Claim 20, characterised in that the hose (10, 30, 30') has an occluder (16) towards the end of the hose remote from the vacuum cleaner apparatus for occluding passage of air through the hose so that suction applied by the vacuum cleaner apparatus creates a reduced pressure within the hose sufficient to shorten the hose to its retracted length.
22. A hose according to Claim 20 or 21, characterised in that the hose (30, 30') includes a retainer (34, 35, 34', 35', 42, 49) arranged to retain the hose in its retracted length such that the hose and retainer can be removed from the vacuum cleaner and stored separately in a retracted state.

23. A hose according to any one of Claims 20 to 22, characterised in that the retainer includes an outer sleeve (34, 35, 34', 35', 42) within which the hose is retracted.
24. A method of operating vacuum cleaner apparatus including the steps of applying suction to one end of a flexible hose (10, 30, 30') having a helical support member (11') and a sleeve (12') of a flexible material attached with the support member, using a cleaning head (15) at the opposite end of the hose to clean, occluding flow of air through the hose at the opposite end (14), allowing pressure in the hose to reduce sufficiently to retract the hose in length and to fold the sleeve (12') outwardly between turns of the support member (11') without substantially reducing the bore through the hose, restraining the hose in its retracted state, and discontinuing the suction power.

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Fig.1.

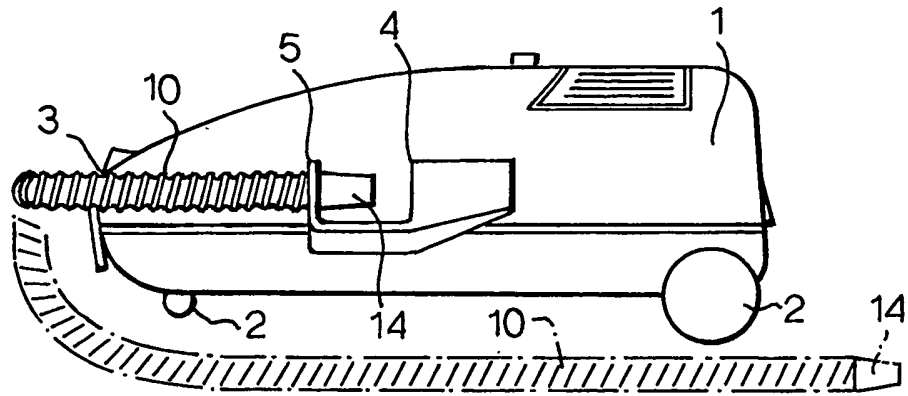
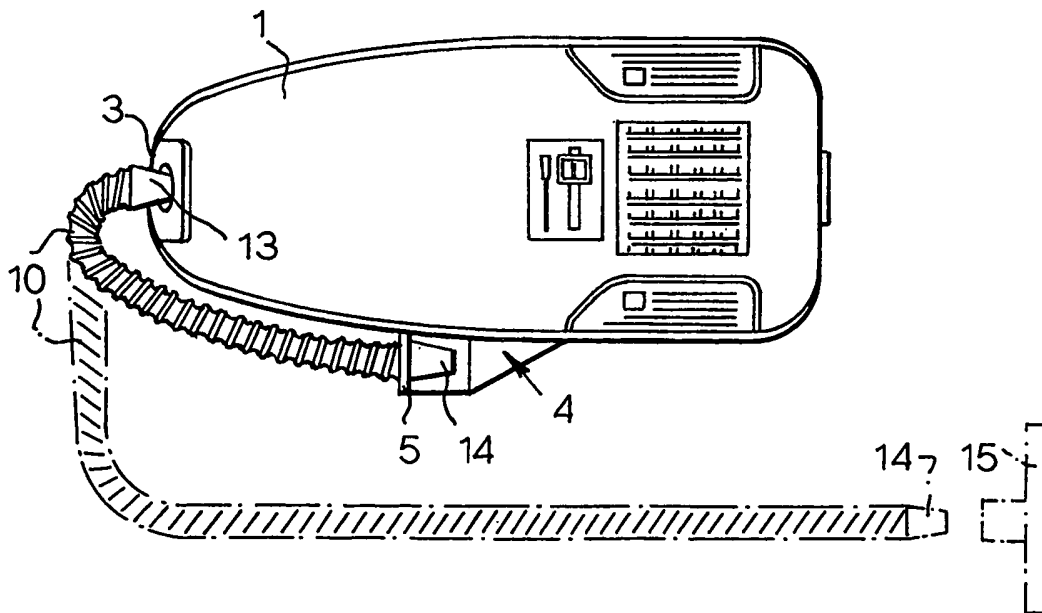


Fig.2.



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Fig.3.

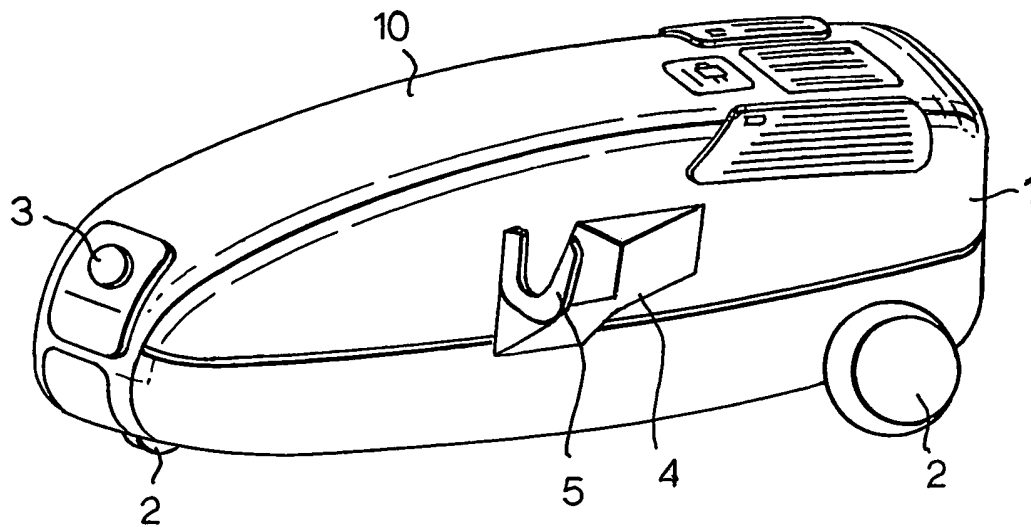
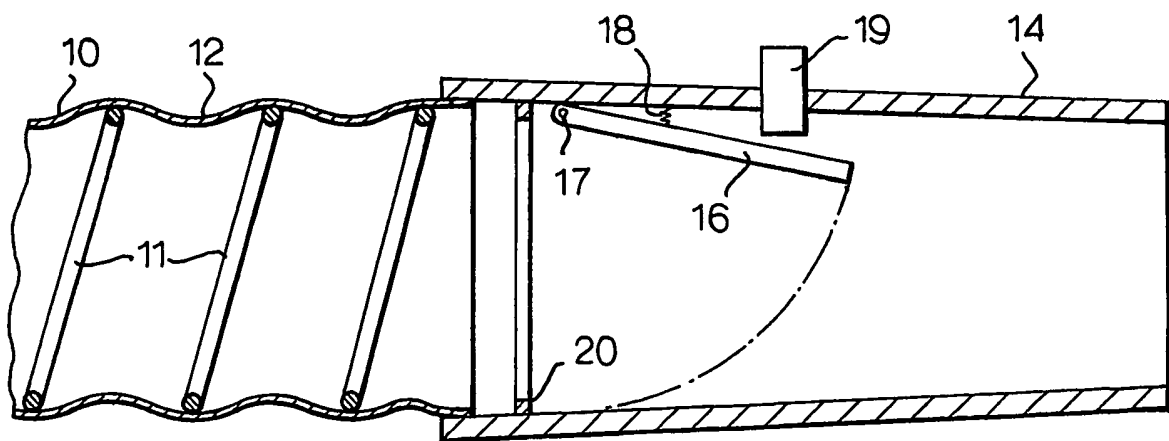


Fig.4.



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Fig.5.

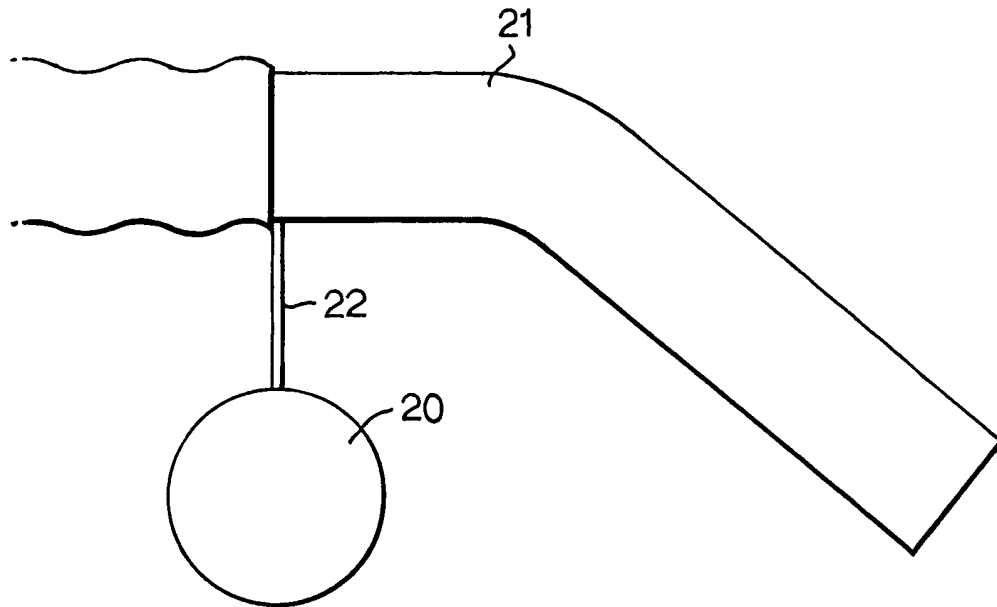


Fig.6.

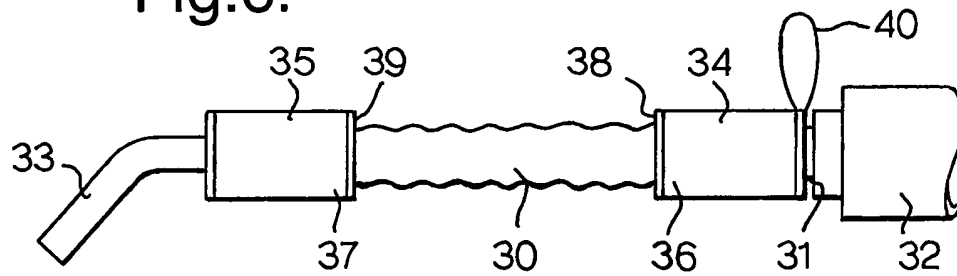


Fig.7.

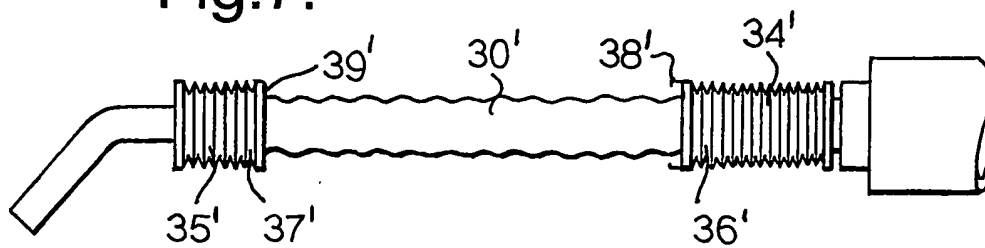


Fig.8.

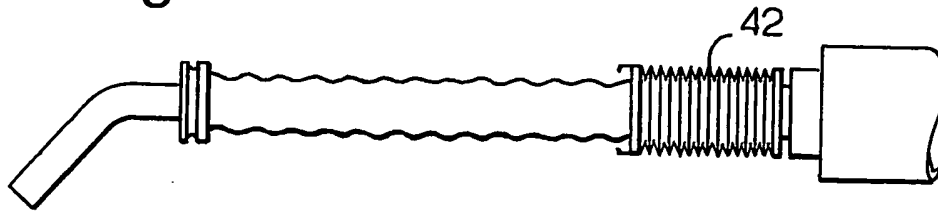


Fig.9.

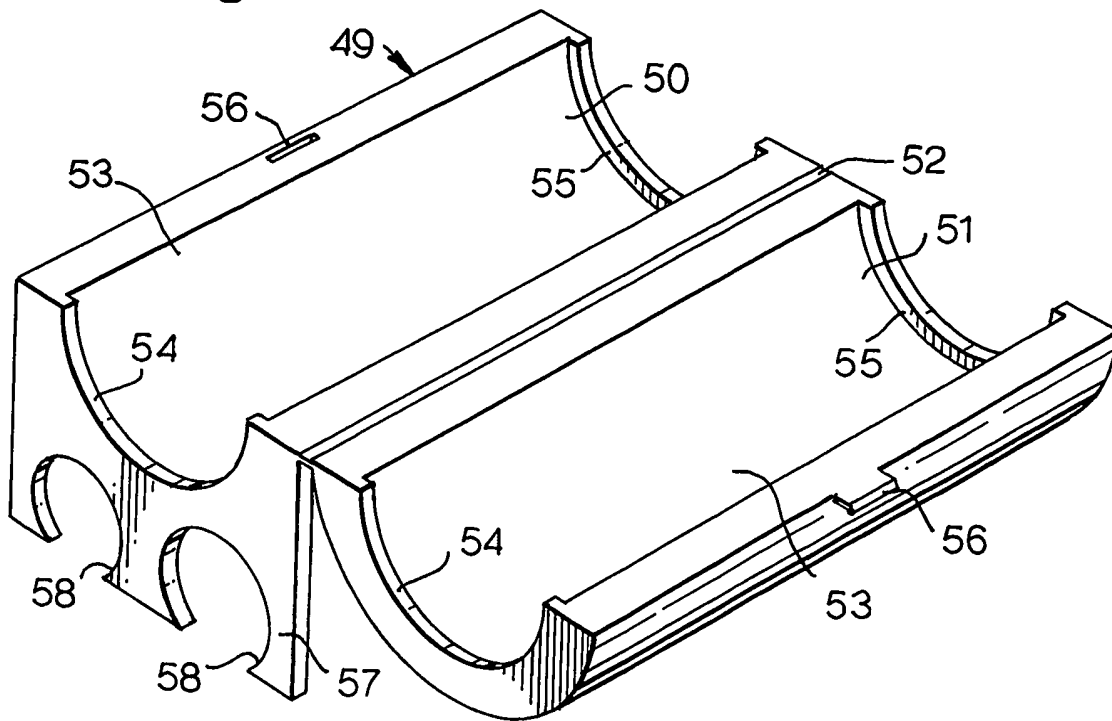
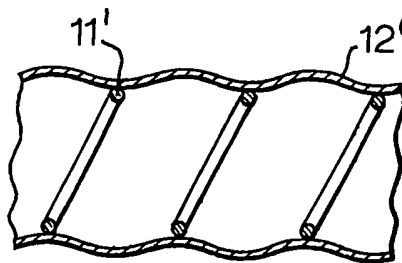


Fig.10.



INTERNATIONAL SEARCH REPORT

Int'l Application No

PCT/GB 02/04200

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A47L9/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS-SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
IPC 7 A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 38 329 A (BOSCH SIEMENS HAUSGERAETE) 4 March 1999 (1999-03-04) column 1, line 50 - line 55 column 2, line 45 - line 53 column 2, line 67 - column 3, line 1 column 3, line 22 - line 42 column 4, line 1 - line 2 figures 1,2	1-8, 14-20
X	WO 99 35954 A (BOSCH SIEMENS HAUSGERAETE) 22 July 1999 (1999-07-22) page 4, line 17 - line 24; figures 1-4	1,14,15, 19
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Further documents are listed in the continuation of box C.



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Date of the actual completion of the international search

5 November 2002

Date of mailing of the international search report

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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X	US 4 704 765 A (ATAKA YASUKAZU) 10 November 1987 (1987-11-10) column 4, line 25 - line 39; figures 8,9A,9B,10,11	1-3,8
A	GB 2 310 369 A (VAX LTD) 27 August 1997 (1997-08-27) page 5, paragraphs 2,3	1,14,15, 19
A	US 2 867 833 A (DUFF JACK E) 13 January 1959 (1959-01-13) column 1, line 15 - line 19 column 1, line 38 - line 42 column 2, line 30 - line 34 column 3, line 20 - line 26 column 4, line 5 - line 12	2,3,7,8, 18

INTERNATIONAL SEARCH REPORT

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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No:
X	US 4 704 765 A (ATAKA YASUKAZU) 10 November 1987 (1987-11-10) column 4, line 25 - line 39; figures 8,9A,9B,10,11	1-3,8
A	GB 2 310 369 A (VAX LTD) 27 August 1997 (1997-08-27) page 5, paragraphs 2,3	1,14,15, 19
A	US 2 867 833 A (DUFF JACK E) 13 January 1959 (1959-01-13) column 1, line 15 - line 19 column 1, line 38 - line 42 column 2, line 30 - line 34 column 3, line 20 - line 26 column 4, line 5 - line 12	2,3,7,8, 18